REMARKS

Initially, Applicant's attorneys would like to thank the Examiner for indicating that claims 8-16 contain allowable subject matter. Claims 8-18 are in this application with claim 7 having been withdrawn by the election above, and new claims 17 and 18 added by the amendments to the claims herein.

In the office action the Examiner objects to the specification because the continuing data requires updating. This objection has been addressed by the amendments to the specification herein. Accordingly, withdrawal of the objection is respectfully requested.

Next the specification is objected to under 35 U.S.C. § 112, first paragraph. The Examiner asserts that the applicant has failed to incorporate a foreign test standard into the specification. In response, those portions of the specification on pages 20 and 25 which reference JIS K 7127 and JIS K 5400 have been amended to reference their English language International Standards Organisation (ISO) counterparts. JIS K 7127 corresponds with ISO 527-3, and JIS K 5400 corresponds to ISO 2409. Accordingly, it is submitted that as amended the instant application no longer references a foreign test standard. In addition, submitted herewith as Appendix 1 is a declaration from Mr. Toshio Hoshina dated October 22, 2005, providing true copies from the original translated English language versions of the JIS standards references as published by the Japanese Standards Association. It is submitted that by these amendments and submissions, the rejection under 35 U.S.C. § 112, first paragraph has been overcome. Accordingly, withdrawal of the rejection is requested. For this same reason it is requested that the rejection of claims 8-16 under 35 U.S.C. § 112, first paragraph also be withdrawn.

Next the Office Action rejects claims 8-16 under 35 U.S.C. § 112, second paragraph. The Examiner objects to the language of claim 8 because it allegedly is unclear as to which component the supporting body contacts. In response Applicants respectfully traverse the Examiner's rejection as claim 8 specifically recites "sequentially laminating." Thus, it would be readily apparent to one of skill in the art that the peelable layer is laminated to the supporting body first, followed by the conductive layer and then the adhesive layer. Accordingly, it is submitted that the language of claim 8 is not indefinite.

In addition the Examiner objects to the language of claims 12 and 15 for including two different ranges within the same claim. To address this objection claims 12 and 15 have been amended herein and new claims 17 and 18 added by these amendments.

As to the antecedent basis issue, claim 13 has been amended to recite "a color filter layer," Therefore it is respectfully submitted that the rejection of claims 8-16 under 35 U.S.C. § 112, second paragraph, have been overcome, and their withdrawal is requested.

Accordingly, it is submitted that all of the claims pending are in condition for allowance a Notice of which is respectfully requested.

The Commissioner is authorized to charge any additional fee that may be required or credit any overpayment to Deposit Account No. 50-0320.

Respectfully submitted,
FROMMER LAWRENCE & HAUG LLP

By: Ronald R. Santucci
/Ronald R. Santucci
Reg. No. 29,988
(212) 588-0800

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DECLARATION

I, Toshio Hoshina of 25-7, Kamoi 1-chome, Yokosuka-shi, Kanagawa-ken, 239-0813 Japan, do hereby solemnly declare that the attached documents, JIS K 5400 and JIS K 7127 in English, are true copies from the original translated and published by the Japanese Standards Association.

Declared at Kanagawa-ken, Japan

This 22nd day of October, 2005

Toshio Hoshina

Toshio Hoshina

UDC 667.61:620.1

JIS

JAPANESE INDUSTRIAL STANDARD

Testing methods for paints

JIS K 5400-1990

Translated and Published

by

Japanese Standards Association

Printed in Japan

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority

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(c) In the case of evaluating by rubbing flaw, when in five time tests not less than twice rubbing flaw(²) on the paint film is not confirmed, exchange the pencil with the pencil of upper concentration symbol to carry out the test similarly, find out the pencil by which the rubbing flaw of paint film becomes not less than twice, and record the concentration symbol lower by one step from that of the pencil.

Note (²) The rubbing flaw means the flaw which slightly bites in the surface of paint film and the cratering of paint film by pressure is not the object. Remove the carbon powders by using an eraser so as not to flaw the paint film at the tested portion, and observe at right angles with the rubbing direction from an angle of 45 degrees to the test piece surface visually and take the flaw discriminable as the "rubbing flaw".

(5) Evaluation The evaluation shall be as follows:

(a) In the Case of Evaluating by Breakage of Paint Film Relating to two pencils adjacent to each other in concentration symbol, obtain a set of those of twice or more in breakage and of less than twice and take the concentration symbol of pencil to be less than twice as the pencil scratching value of paint film.

(b) In the Case of Evaluating by Rubbing Flaw of Paint Film Relating to two pencils adjacent mutually in concentration symbol, obtain a set of pencils to be not less than twice and less than twice in rubbing flaw, and take the concentration symbol of pencil to be less than twice as the pencil rubbing value of paint film.

(6) Specified Conditions of Product Standard The specified conditions of product Standard shall be as follows:

(a) Classification of test panel

(b) Coating and drying conditions

(c) Evaluation method (breakage and rubbing flaw)

8.5 Adhesion As to adhesion, there are cross-cut adhesion method, cross-cut tape method and X-cut tape method.

8.5.1 Cross Cut Test

(1) Summary Observe visually the adhesion condition of paint film when cross-cut state cut flaws reaching the substrate surface are attached through the paint film on the test piece.

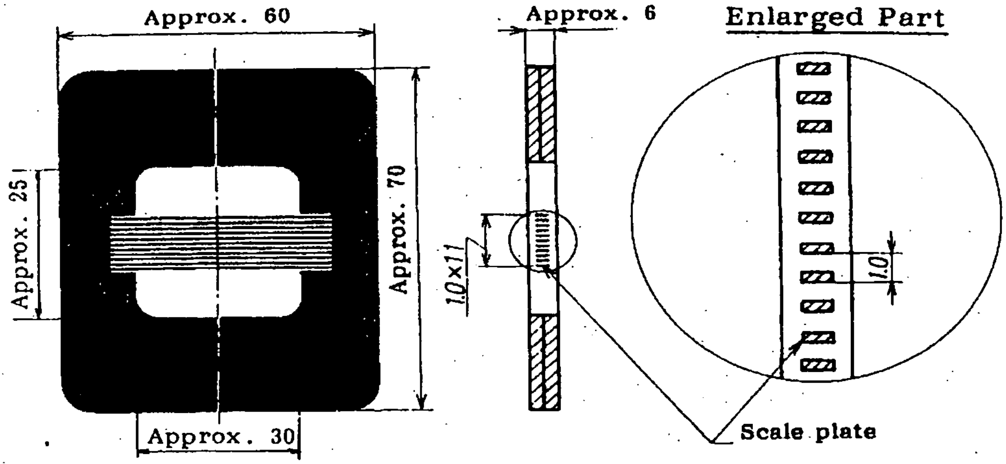
(2) Apparatus and Material The apparatus and material shall be as follows:

(a) Cutter Knife The cutter knife shall be in accordance with 7.2 (2) (e).

(b) Cutter Guide A cutter guide of clearance interval specified in product Standard of sample shall be used. An example is shown in Fig. 51.

Fig. 51. An Example of Cutter Guide Clearance 1 mm

Unit: mm



(c) Test Panel Unless particularly specified, a steel panel (150 mm x 70 mm x 0.8 mm).

(3) Preparation of Test Piece Coat the sample on single side of steel panel by 3.3 according to the method specified in product Standard of sample, after drying stand it as it is in the standard condition for not less than 1 h and take it as the test piece.

(4) Operation The operation shall be carried out as follows:

(a) On a portion of middle part of test piece, attach cut flaws of cross-cut state by using a cutter guide of clearance interval specified in product Standard of sample, or the like. When, specially there is no interference, select from the range of Table 17.

Table 17. Interval of Cut Flaws and Number of Cross-Cuts

Clearance interval	1 mm	2 mm	5 mm
Number of cross cuts	100	15	9

(b) When attaching cut-flaw, always use a new knife edge of cutter knife, and keep a definite angle in the range of 35 to 45 deg. to the surface of paint film.

(c) As to the cut-flaws, draw the cutter knife so as to reach through paint film to the substrate of test panel at an equal speed of approximately 0.5 s per one cut flaw.

(5) Evaluation The evaluation shall be as follows:

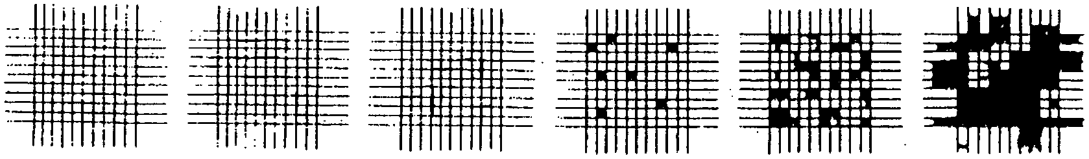
(a) Observe the condition of cross-cut flaws attached on the surface of paint film of test piece and, taking Fig. 52 as reference, evaluate according to Table 18.

(b) In the case of multi-layer film, record that the peeling is caused from which layer.

Table 18. Evaluation Point Number of Cross-Cut Adhesion Test

Evaluation point number	Condition of flaw
10	Each cut flaw is fine, its both sides are smooth and at intersecting point of cut flaws and at each at square are free from peeling.
8	At the intersecting point of cut flaws there is a slight peeling, each square cut is free from peeling, and the area of loss part is within 5 % of all square area.
6	At the both sides and intersecting point of cut-flaws there are peeling and the area of defect loss part is 5 to 15 % of the total square areas.
4	The peeling width due to cut-flaw is broad and the area of defect loss part is 15 to 35 % of total square areas.
2	Peeling width due to cut-flaw is broader than 4 points and the area of defect loss part is 35 to 65 % of total square area.
0	Peeling area is not less than 65 % of total square areas.

Fig. 52. An Example of Evaluation



10 points 8 points 6 points 4 points 2 points 0 point

Note (1) The black part in Fig. 52 shows the area of loss part.

(6) Specified Conditions of Product Standard The specified conditions of product Standard shall be as follows:

(a) Classification of test panel

(b) Coating and drying conditions

(c) Interval of cut-flaws and number of squares

(d) Paint film layer for evaluating and designating the peeling

8.5.2 Cross Cut Tape Test

(1) Summary Attach cut flaws reaching the substrate passing through the paint film on the test piece in cross-cut condition, adhere on this square the pressure sensitive adhesive tape and observe the adhering condition of paint film after peeling off the tape visually.

(2) Apparatus and Materials The apparatus and materials shall be as follows:

(a) Cutter Knife The cutter knife shall be in accordance with 7.2 (2) (e).

(b) Cutter Guide The cutter guide shall be in accordance with 8.5.1 (2) (b).

(c) Pressure Sensitive Adhesive Cellophane Tape The pressure sensitive adhesive cellophane tape specified in JIS Z 1522, having width of 18 mm or 24 mm, adhesive force of 2.94 N/10 mm {300 gf/ 10 mm} or more.

(d) Test Panel A steel panel (150 mm x 70 mm x 0.8 mm).

(e) Eraser The rubber eraser specified in JIS S 6050.

(3) Preparation of Test Piece Caot the sample on single surface of steel panel by 3.3, according to the method specified in product Standard of sample, dry and thereafter stand as it is in the standard condition for not less than 1 h to take it as the test piece.

(4) Operation The operation shall be carried out as follows:

(a) Attach cut-flaws in cross-cut state of clearance intervals specified in product Standard of sample on a portion of the middle part of test piece according to 8.5.1 (4) (a).

(b) When attaching cut-flaws, always use a new knife edge of cutter knife, and keep a definite angle in the range of 35 to 45 deg. to the surface of paint film.

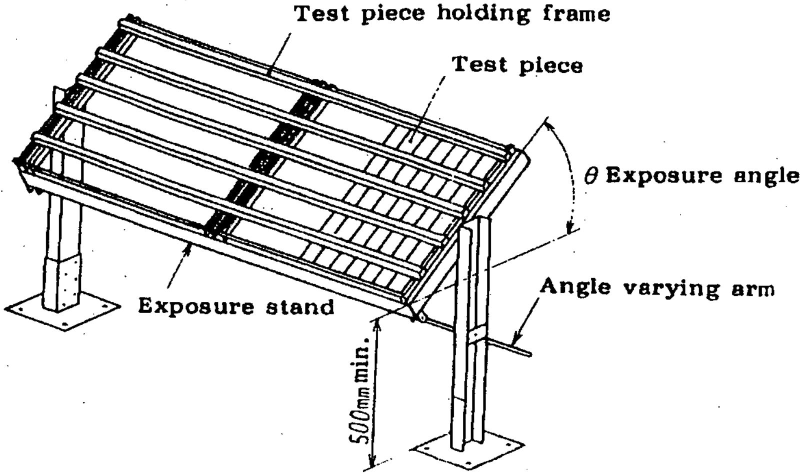
(c) As to the cut flaws, draw the cutter knife so as to reach through paint film to the substrate of test panel at an equal speed of approximately 0.5 s per one cut flaw.

(d) Adhere a pressure sensitive adhesive cellophane tape on the squares so as the length of adhering part to become approximately 50 mm, and rub by eraser to adhere completely the tape on the paint film.

(e) After adhering the tape in 1 to 2 min, hold the one side end of tape and instantly peel off with keeping at right angles with the surface of paint film as shown in Fig. 53.

(4) Eval. Sample The eval. sample shall be the paint sample specified in product Standard.

Fig. 85. An Example of Weathering Test Stand



(5) Preparation of Test Piece The preparation of test piece shall be carried out as follows:

(5.1) Division and Designation of Test Pieces The test pieces shall be combined with division names as given in Table 29 according to the paint used for weathering test and the using purpose in that test.

Table 29. Divison and Designation of Test Piece

Name of Division	Weathering test piece (The test for actual weathering test)	Original test piece([2]) (The test piece to substitute for the conditions of film before weathering test)
Sample test piece (A test piece prepared using a sample for test)	Sample weathering test piece	Sample original test piece
Evaluation sample test piece (A test piece prepared using an evaluation sample specified in 3.6.1 for comparing the characteristics of the samples)	Evaluation sample weathering test piece	Evaluation sample original test piece

Note (2) It shall be placed in the room free from direct sunlight, gases, vapours, dust, etc. which affect on the coated film, while keeping the coated film upward not to overlap for each sheet, during weathering test periods of a sample.

(5.2) Coating System of Test Piece The coating system including the pretreatment, overcoating from undercoat up to topcoat, coating method, drying method, etc. of test panels shall be specified in product Standard.

(5.3) Treatment of Test Piece Treat the periphery and back surface of test piece according to the method specified in product Standard so as not to receive influence during the period of wheathering test.

(5.4) Number of Test Pieces The number of weathering test pieces to be prepared with sample and eval. sample shall be specified in product Standard.

(5.5) Marking of Test Piece The position of marking shall be such a position as the end parts or back surface, etc. of test piece that there are no interference to weathering test and its evaluation. The contents of marking shall be classification of sample, weathering test place, conditions, etc. and be capable of being discriminated clearly by making simple using symbol, number, etc. and by such method as not to give influence the sample, even after the weathering test.

(6) Operation The operation shall be carried out as follows:

(6.1) Beginning of Test After drying and holding under the conditions specified in product Standard, attach the test piece to the weathering test stand with the test surface upward and begin the test. The beginning time shall be specified in product Standard. However, the day to begin the test(3) shall be the day of cloud or fine weather.

Note (3) Unless particularly specified, it shall be April and October.

(6.2) Period of Test The period of weathering test shall be the period specified in product Standard.

(6.3) Period of Test and Observation The period for testing and observing the paint film, unless particularly specified, shall be every three months after beginning, and after lapse of one year, be every six months.

(6.4) Evaluation Item The item to be observed and evaluated by testing weathering test piece shall be specified in product Standard.

(6.5) Evaluation Method The evaluation shall be carried out relating to the item specified in product Standard according to the following two methods. However, the paint film within respectively 10 mm in width from the periphery of test piece and ends of paint film shall not be made the object of observation and evaluation.

The pretreatment required at the time of evaluation such as washing shall be specified in product Standard.

(6.5.1) Visual Evaluation Method

(a) Observe visually the degree of variation of colour and gloss caused by weathering test on the sample weathering test piece and sample original test piece and examine by comparing the both.

(b) Relating to eval. sample weathering test piece, observe visually similarly to (a), and examine by comparing the difference of variations of sample and eval. sample.

(c) Relating to cracking, peeling, blistering, pinholes, etc., observe the size of their degree by directly comparing weathering test pieces of sample and eval. sample.

(6.5.2) Numerical Value Evaluation Method After completion of test, relating to respective sample weathering test piece and sample original condition test piece, observe and evaluate as follows:

(a) Relating to degrees of cracking, peeling, blistering, chalking, evaluate according to the evaluation scale of 3.6.2. Carry out the test of chalking degree according to 9.6.

(b) After carrying out the chalking test, clean(4) the test piece, then dry, and relating to the sample original test piece and sample weathering test piece measure the gloss retention according to the method of 7.6.

(c) Relating to the test piece completed with the measurement of (a) and (b), measure the colour difference according to the method of 7.4.2.

Note (4) Rub the whole surface of test piece with the viscose sponge, polyvinyl chloride sponge made sufficiently soft by immersing into water. For rubbing, always pour water to make the test piece not to by adhering matters or the like and remove the adhering matters. After completion of washing, stand the test piece on a clean place in room to dry.

(7) Record of Weathering Test Results Record the result of observation of weathering test piece at each time, after completion of its whole period arrange them, evaluate the weather resistance of sample and record.

(8) Meteorological Observation Periodically observe to record the meteorology of the weathering test place or its address and use the record(5) as the informative reference at the time of evaluating the results of weather resistance of sample. When abnormality exists in meteorology, record separately. The items for meteorological observation shall be as follows:

Weather, air temperature, humidity, precipitation amount, sun radiation time, solar radiation amount.

(6.3) Time of Test and Observation and Evaluation Relating to the surface of paint film of test piece completed with outdoor exposure, observe existence of rust, further immerse the test piece into suitable solvent, peel whole part of paint film, observe the rusting conditions of test panel substrate, and compare the degree with the eval. sample treated similarly at the same time. However, the paint film within respectively 10 mm from the periphery of test piece and ends of paint film shall not be made the object of observation.

(7) Record of Test Results The record of test results shall be in accordance with 9.9 (7).

(8) Meteorological Observation The meteorological observation shall be in accordance with 9.9 (8).

(9) Execution and Control of Test The execution and control of test shall be in accordance with the specification of product Standard.

(10) Test Conditions to Be Specified in Product Standard The test conditions to be specified in product Standard shall be as follows:

(a) Material quality, thickness and number of sheets of test panel

(b) Evaluation sample

(c) Coating and drying methods of sample

(d) Beginning time and period of test

(e) Keeping period of record

(f) Execution and control methods of test

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JAPANESE INDUSTRIAL STANDARD

Testing Method for Tensile Properties of Plastic Films and Sheets

JIS K 7127-1989

Translated and Published
by
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Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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JAPANESE INDUSTRIAL STANDARD JIS

Testing Method for Tensile Properties of Plastic Films and Sheets

K 7127-1989

1. Scope

This Japanese Industrial Standard specifies the general tensile testing method of plastic films and sheets of 1 mm and under in thickness. However, this Standard does not apply to fibre reinforced plastic films and sheets, and to foamed plastic films and sheets.

Remarks 1. This tensile testing method is a general testing method. When a different tensile testing method is specified in the applied quality Standard, that testing method may be followed.

2. When tensile properties of different materials or products are to be compared, the test shall be carried out under the same conditions of shape of test pieces, dimensions, preparation of test pieces, pretreatment of test pieces, tensile speed, and atmoshpere of place of test.

3. The units and numerical values given in { } in this Standard are based on the traditional units and are appended for informative reference.

2. Definition

For the purpose of this Standard, the following definitions apply. Other definitions are given in JIS K 6900.

(1) tensile stress A value of the tensile load applied to a test piece at an arbitrary time point devided by the initial sectional area between the bench marks of the test piece. As the initial sectional area, an average value shall be used for the modulus of elasticity and the smallest area, for other purposes.

(2) tensile yield strength The tensile stress at the first point on the load-elongation curve where the increase of elongation without the increase of load is observed.

(3) tensile breaking strength The tensile stress at the moment of fracture of the test piece.

(4) gauge length The distance between two bench marks which are scribed in the parallel portion of the test piece before testing for the purpose of measuring the strain.

(5) strain A dimensionless quantity obtained by dividing the changed gauge length by the initial gauge length.

(6) tensile proof stress The tensile stress which causes a certain amount of permanent set on the test piece. The tensile proof stress is used in stead of the yield point in materials indicating no yield point.

Applicable Standards, Corresponding International Standard and Reference Standard: See page 12.

(7) specified strain tensile strength The tensile stress corresponding to the specific strain on a tensile stress-strain curve.

(8) tensile yield elongation The elongation corresponding to the tensile yield strength.

(9) tensile breaking elongation The elongation corresponding to the tensile breaking strength.

(10) elongation at maximum tensile load The elongation corresponding to the tensile strength.

(11) tensiel limit of proportionality The tensile stress at which the relation between the stress and the strain begins to deviate from a linear relation.

(12) tensile modulus of elasticity The ratio of the tensile stress to the strain corresponding thereto within the tensile limit of porportionality. When the tensile stress-strain curve has no linear portion, the modulus of elasticity shall be determined by the inclination of a tangent at the initiation point of plastic deformation.

(13) tensile secant modulus of elasticity The ratio of the tensile stress to the strain at a specified strain on the tensile stress-strain curve.

3. Conditioning of Test Pieces, Testing Temperature and Humidity

3.1 Conditioning The test pieces shall, as a rule, be conditioned prior to the test in the standard temperature and humidity condition Grade 2 (temperature of 23 ± 2°C and relative humidity of 50 ± 5 %) specified in JIS K 7100, for 88 h (1) or over.

Note (1) If it is ascertained that the measured values of test pieces conditioned for 88 h or over and those conditioned for 88 h or under do not differ from each other, the time of conditioning may be reduced.

3.2 Testing Temperature and Humidity The test shall, as a rule, be carried out in a room kept at the standard temperature and humidity condition Grade 2 (temperature of 23 ± 2°C and relative humidity of 50 ± 5 %) specified in 3.1.

4. Apparatus and Appliances

4.1 Testing Machine A testing machine in which the travelling speed of cross head can be maintained constant during the test, and being constituted of the following shall be used.

(1) Grippers The grippers shall consist of two metal ones which can hold a test piece at the moving part and the stationary part of the testing machine. The test piece shall be attached to the moving part and the stationary part of the testing machine so as when load is applied during the test, the longitudinal axis of the test piece

and the imaginary centre line of the two grippers align in a straight line.

The grippers should preferably be of the self-aligning type. The grippers shall not cause a slip of the test piece during the test and an oblique stressing of the test piece until it breaks.

Further, the gripping surface of the grippers should preferably be such that it can apply a constant gripping pressure to the test piece during the test.

(2) Load Indicator The load indicator shall be the one which can record all of the tensile loads applied to the test piece during the test in correspondence with the lapse of testing time, and can indicate the load values with an accuracy of 1 % or superior at the set testing speed.

4.2 Extensometer The extensometer shall be the one which can record all of the changes in the gauge length during the test in correspondence with the lapse of test time and can indicate the elongation values with an accuracy of 1 % or superior at the set testing speed.

4.3 Dimension Measuring Instruments

4.3.1 Dial Gauges The dial gauges for measuring the thickness of the test piece shall be the dial gauges specified in JIS B 7509 or those equal or superior thereto in accuracy.

Remark: The thickness measurement, when specified in corresponding Japanese Industrial Standard of films and sheets formed of different resins, shall be in accordance with that Standard, and when not specified in that Standard, shall be agreed between the parties concerned with delivery.

4.3.2 Micrometers The micrometers for measuring the width of the test piece of hard plastic films and sheets shall be the micrometer callipers for external measurement having a measuring range of 0 to 50 mm specified in JIS B 7502 or those equal or superior thereto in accuracy.

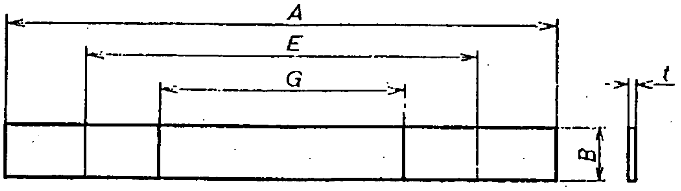
4.3.3 Vernier Callipers The vernier callipers for measuring the length and width of the test piece shall be those specified in JIS B 7507 having the maximum measuring length of 200 mm and the minimum reading of 0.05 mm or those equal or superior thereto in accuracy.

4.3.4 Metal Straight Rulers The metal straight rulers for measuring the length and width of the test piece shall be the Grade 1 straight rulers specified in JIS B 7516 or those equal or superior thereto.

5. Test Pieces

5.1 Shapes and Dimensions of Test Pieces The shapes and dimensions of the test pieces shall be classified into the three types as shown in Figs. 1 to 3.

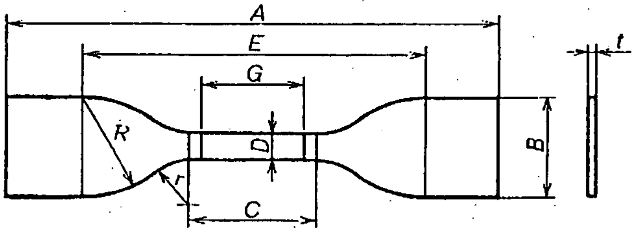
Fig. 1. No. 1 Type Test Piece



Unit: mm

Portion of test piece	Dimension
A Overalsl length	200
B Width	10 to 25
G Gauge length	100 ± 1
E Distance between grippers	150 ± 5
t Thickness	–

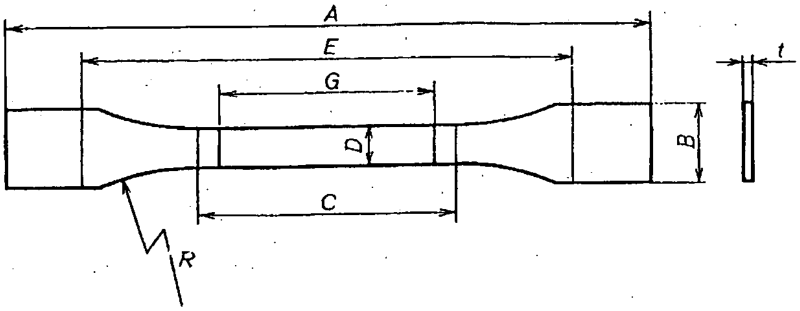
Fig. 2. No. 2 Type Test Piece



Unit: mm

Portion of test piece	Dimension
A Overall length	115
B Width of both ends	25 ± 1
C Length of parallel portion	33 ± 2
D Width of parallel portion	6 ± 0.4
E Distance between grippers	80 ± 5
G Gauge length	25 ± 0.25
r Small radius	14 ± 1
R Large radius	25 ± 2
t Thickness	–

Fig. 3. No. 3 Type Test Piece



Unit: mm

	Portion of test piece	Dimension
A	Overall length	150
B	Width of both ends	20 ± 0.5
C	Lenght of parallel portion	60 ± 0.5
D	Width of parallel portion	10 ± 0.5
E	Distance between grippers	115 ± 5
G	Gauge length	50 ± 0.5
R	Radius of shoulder roundness	60
t	Thickness	–

Remark: Which test piece is to be used depends upon the related standard or the agreement between the parties concerned with delivery.

Further, the test pieces of No. 4 or No. 5 type specified in Appendix can be used depending upon agreement between the parties concerned with delivery.

5.2 Preparation of Test Pieces The test pieces shall be prepared by cutting off them from the materials using a sharp edge such as a razor edge or by punching. Test pieces having a notch in the cut surface shall not be used.

When marking the test pieces with bench marks, an ink or a crayon which does not affect the test pieces shall be used.

The bench marks shall not be provided by scratching or indenting the surface of test piece.

5.3 Number of Test Pieces

5.3.1 The number of test pieces shall be five or more.

5.3.2 When testing an anisotropic material, five or more test pieces taken for respectively longitudinal and transversal directions shall be tested.

5.3.3 The value of a test piece whose break has occurred outside the parallel portion shall be omitted (2), and an additional test piece for that shall be tested.

Note (2) For the test result, in which the parallel portion has been sufficiently elongated, nevertheless the break occurred outside the parallel portion, may be adopted in accordance with an agreement between the parties concerned with delivery.

6. Testing Speed

6.1 The testing speed shall be the speed of separation of the grippers during the test. In the test machine in which the separating speed of grippers is substantially the same regardless of a blank operation or a loaded operation, the separating speed t the time of the blank operation may be regarded as the testing speed.

6.2 The testing speed shall be selected from the following group of testing speeds. Which testing speed is to be applied shall be determined in accordance with the other reference Standards. When the testing speed is not specified, it shall be determined in accordance with the agreement between the parties concerned with delivery.

Testing speed A: 1 ± 0.5 mm/min
Testing speed B: 2 ± 0.4 mm/min
Testing speed C: 5 ± 1.0 mm/min
Testing speed D: 10 ± 2.0 mm/min
Testing speed E: 20 ± 2.0 mm/min
Testing speed F: 50 ± 5.0 mm/min
Testing speed G: 100 ± 10 mm/min
Testing speed H: 200 ± 20 mm/min
Testing speed I : 500 ± 50 mm/min

6.3 When the tensile modulus of elasticity is to be measured, the testing speed A shall be used unless otherwise specified in the other standard. When the testing speed for measurement of the tensile modulus of elasticity differs from that for measurement of the tensile strength and elongation, the test shall be performed on the separate test pieces.

7. Operation

7.1 Measure the width and thickness of the parallel portion of each test piece at three points, i.e., centre between the bench marks and mid points at equal distance from the respective two bench marks. In the case of test pieces prepared by punching, the average width of parallel portion of the punching edge may be regarded as the width of test pieces. In this case, measure the width of parallel portion of the punching edge to verify that it has the specified dimension.

Test pieces shall be measured with an accuracy of 0.1 mm or superior for the width and 0.001 mm for the thickness.

Remark: The measurement of thickness may be performed with a micrometer or by mechanical scanning according to an agreement between the parties concerned with delivery, and for very thin films or embossed films, the thickness may be determined by the gravimetric method.

7.2 Mount the grip part of a test piece in the gripper of the testing machine. Attention shall be taken so that an imaginary line connecting two points at which two grippers are respectively attached to the testing machine is in alignment with a longitudinal axis of the test piece. In addition, the test piece shall be gripped firmly so as not to slip in the grippers. In this case, in order to eliminate the influence of grippers on the test piece, papers or rubber sheets may be inserted between the test piece and the grippers.

7.3 After setting the testing speed to a specified value, start the testing machine.

7.4 In accordance with the object of test, carry out the following measurement.

(1) Record a load-elongation curve till the strain attains to a specified value within the area of elastic deformation

(2) Load and gauge length at yield

(3) Load and gauge length at the maximum load

(4) Load and gauge length at break

(5) Load at a specified gauge length

7.5 When the modulus of elasticity is to be determined, set the testing speed specified in 6.2 to A, start the testing machine, and proceed in accordance with 7.4 (1).

Remark: For determining the modulus of elasticity, a No. 1 type test piece of 10 mm in width and 100 mm in distance between grips should preferably be used.

8. Calculation

The calculation shall be as follows:

(1) Tensile yield strength, tensile strength, tensile breaking strength, or specified strain tensile strength shall be calculated according to the following equation.

$$\sigma = \frac{F}{A}$$

where σ : tensile yield strength, tensile strength, tensile breaking strength or specified stress tensile strength (N/mm^2) {kgf/mm^2}

F : load at yield, the maximum load, breaking or specified stress (N) {kgf}

A : initial minimum sectional area of test piece (mm^2)

(2) Tensile yield elongation, tensile elongation at break, or elongation at the maximum tensile load shall be calculated according to the following equation.

$$\varepsilon=\frac{L-L_0}{L_0}\times 100$$

where ε: tensile yield elongation, tensile elongation at break or elognation at the maximum tensile load (%)

L: gauge length at yield, fracture or the maximum load (mm)

L_0: initial gauge length (mm)

(3) Tensile modulus of elasticity shall be calculated according to the following equation by using the initial linear portion of tensile stress-strain curve.

$$E_m=\frac{\Delta\sigma}{\Delta\varepsilon}$$

where E_m: tensile modulus of elasticity (N/mm^2) {kgf/mm^2}

$\Delta\sigma$: difference between stresses calculated by the initial sectional area at two points on the linear portion of the stress-strain curve (N/mm^2) {kgf/mm^2}

$\Delta\varepsilon$: difference between strains at the above two points

(4) Tensile proof stress shall be determined from the stress at the intersection of a straight line drawn parallel to the initial linear portion of tensile stress-strain curve and the tensile stress-stress curve (refer to curve B in Fig. 4), or calculated according to the following equation.

$$\sigma_{0s}=\frac{F_{0s}}{A}$$

where σ_{0s}: tensile proof stress at a specified permanent set (N/mm^2) {kgf/mm^2}

F_{0s}: load at the specified permanent set (N) {kgf}

A: initial minimum sectional area of test piece (mm^2)

(5) Tensile secant modulus of elasticity shall be calculated according to the following equation using a tensile stress value corresponding to a specified strain.

$$E_{sc}=\frac{F_s}{\varepsilon_s\cdot A}$$

where E_{sc}: tensile secant modulus of elasticity at a specified strain (N/mm^2) {kgf/mm^2}

F_s: load required to produce the specified strain (N) {kgf}

ε_s: specified strain

A: initial average sectional area of the test piece (mm^2)

9. Expression of Test Results

(1) The test results relative to the tensile stress and tensile modulus of elasticity shall be calculated one by one, and the average value of the calculation results shall be rounded off to three significant digits in accordance with JIS Z 8401.

(2) The test results relative to the elongation shall be calculated one by one, and the average value of the calculation results shall be rounded off to two significant digits in accordance with JIS Z 8401.

(3) When determining the standard deviation, it shall be calculated according to the following equation, and the calculation result shall be rounded off to two significant digits in accordance with JIS Z 8401.

$$S=\sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

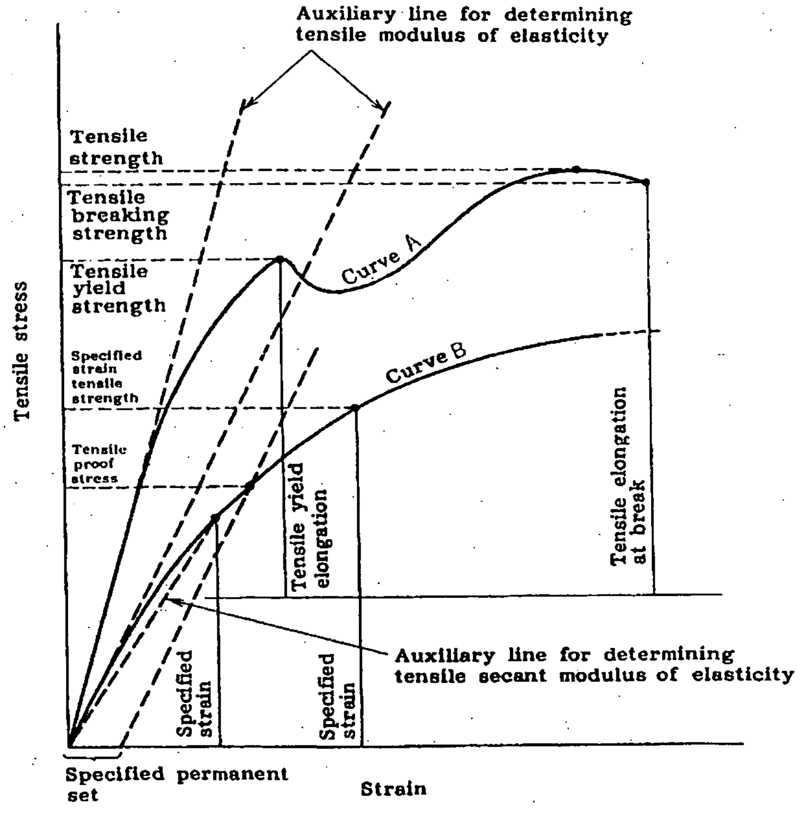
where S: standard deviation

x: one observed value

n: number of observations

$\bar{x}$: average value of an observation group

Fig. 4. Tensile Stress-Strain Curve



(4) The confidence limit of the average value at the confidence coefficient of 0.95 shall be obtained in accordance with JIS Z 9051, if necessary.

10. Report

In the report, following particulars shall be entered, as required.

(1) Kind, grade and manufacturer's name of materials tested

(2) Type of test piece

(3) Direction of taking test piece

(4) Method for preparating test piece

(5) Temperature, humidity and duration of conditioning of test piece

(6) Temperature and humidity of testing room

(7) Number of test pieces tested

(8) Testing speed

(9) Average values and standard deviations (estimation) of tensile yield strength, tensile strength, tensile breaking strength, tensile yield elongation, tensile elongation at break, tensile elongation at the maximum load, tensile modulus of elasticity, tensile proof strength, specified strain tensile strength, and tensile secant modulus of elasticity

(10) Date of test

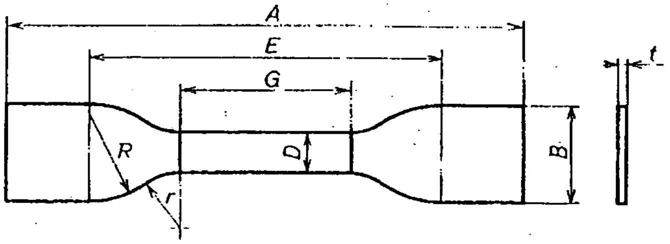
(11) Other particulars to be mentioned

Appendix No. 4 Type Test Piece and No. 5 Type Test Piece

This Appendix specifies the No. 4 type test piece and the No. 5 type test piece.

For the items not specified in this Appendix, the text of this Standard applies.

Appendix Fig. Shape and Dimensions of No. 4 Type Test Pieces and No. 5 Type Test Piece



Portion of test piece		Type of test piece	
		No. 4 type test piece	No. 5 type test piece
A	Overall length	120	120
B	Width of both ends	25 ± 1	25 ± 1
D	Width of parallel portion	$10^{+0.4}_{0}$	$10^{+0.4}_{0}$
E	Distance between grippers	80 ± 5	80 ± 5
G	Gauge length	40^{+2}_{0}	40^{+2}_{0}
r	Small radius	14 ± 1	21 ± 1
R	Large radius	25 ± 1	25 ± 1
t	Thickness	—	—

Applicable Standards:

JIS B 7502-Micrometer Callipers for External Measurement

JIS B 7505-Vernier Callipers

JIS B 7509-Dial Gauges Reading in 0.001 mm

JIS B 7516-Metal Rules

JIS K 6900-Glossary of Terms Used in Plastic Industry

JIS K 7100-Standard Atmospheres for Conditioning Testing of Plastics

JIS Z 8401-Rules for Rounding off of Numerical Values

JIS Z 9051-Interval Estimation of the Population Mean (Standard Deviation Unknown)

Corresponding International Standard:

ISO 1184-1983 (E) Plastics-Determination of tensile properties of films

Reference Standard:

JIS Z 8203-SI Units and the Use of their Multiples and of Certain other Units

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